Technology-Assisted Parent Training Programs for Children and Adolescents With Disruptive Behaviors: A Systematic Review

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ABSTRACT

Objective: To systematically review digitally assisted parent training programs (DPTs) targeting the treatment of children and adolescents with disruptive behaviors.

Data Sources: A search was conducted using PubMed, PsycINFO, and EMBASE databases for peer-reviewed studies published between January 1, 2000, and March 1, 2016. Reference lists of included and review articles were searched manually for additional references.

Study Selection: Broad search terms in varying combinations for parent, training, technologies, and disruptive behavior problems were used. We included English-language articles reporting on the effectiveness of DPTs targeting child or adolescent disruptive behaviors (eg, conduct disorder, oppositional defiant disorder). DPTs designed to use digital media or software programs not to be primarily used within a therapy setting (eg, group, face-to-face) were included.

Data Extraction: Study design, recruitment and sample characteristics, theoretical background, digital program features, user's engagement, and measures of child behavior were extracted.

Results: Fourteen intervention studies (n = 2,427, 58% male, 1,500 in DPT conditions, 12 randomized trials) examining 10 programs met inclusion criteria. Interventions included self-directed noninteractive (eg, podcasts; 3 studies) and interactive (eg, online software; 4 studies) DPTs, remotely administered DPTs combined with professional phone-based coaching (2 studies), and a smartphone enhancement of standard treatment. Interventions were delivered over a mean ± SD period of 8.7 ± 4.2 weeks, most (11/14; 78.6%) were remotely administered, and all recruitment procedures included an outreach for parents outside of mental health–care settings. For programs with > 5 sessions, the mean ± SD completion rate of available sessions was 68.6% ± 13.1%. In comparison to no treatment control, self-directed programs yielded significant improvements in child behavior for children (age < 9 years, Cohen $d = 0.47–0.80$, 4 studies) and adolescents ($d = 0.17, 0.20$, 2 studies). Overall, reduced professional support combined with DPT was not inferior to full-contact conditions and showed small improvement in comparison to usual care ($d = 0.34$). Preliminary indicators also suggested that technology enhancements may increase engagement and outcomes of standard treatment.

Conclusions: The current review indicates the efficacy of DPT across a range of therapy formats applied in real-world settings demonstrating the potential for increased accessibility of evidence-based treatment for youth with disruptive behaviors. Additional studies are needed to extend these findings and to determine moderating effects of different designs.

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Disruptive behavior disorders and related difficulties (eg, aggression, defiance) are among the most prevalent types of mental disorders affecting children and adolescents.[1,2] Untreated disruptive behaviors impose significant emotional and economic costs as well as burden to individuals, families, and societies.[3,4] There are multiple evidence-based treatments for disruptive behaviors,[5] among which, parent training programs have a strong body of evidence supporting their effectiveness.[5–7] The term parent training refers to a body of treatment procedures in which parents are trained to alter their child's behavior at home based on models suggesting that parenting practices play a significant role in directing their children toward both appropriate and nonappropriate behaviors.[8,9] The procedures lean on different theories, such as social learning, used to develop positive, prosocial behaviors; to decrease deviant behaviors; and to nurture a constructive relationship between the parents and the child.[6,10] The promise of this approach is demonstrated in meta-analytic examination of parent training outcomes showing that programs in which only the parent received the intervention resulted in moderate immediate effect size improvements in child behavior, parent behavior, and parental perceptions (effect sizes = 0.47, 0.54, and 0.59, respectively).[11]

The provision of evidence-based treatments for children and adolescents is very limited.[12] Overall, barriers to receiving treatment include lack of trained staff, cost, inconvenient time or location of services, and stigma.[13–15] These barriers lead to poor quality of care for youth with disruptive behaviors. For example, research suggests that psychotropic medications are prescribed for a majority of youth with disruptive behaviors without attempting psychological interventions such as parent training.[16] Other than restricted availability of interventions such as parent training, a systematic review[17] of behavioral parent training programs revealed that at least 25% of identified parents do not enroll and that the percentage of treatment sessions attended by the average participant is 72%.

Digitally based interventions have been introduced to address barriers in mental health services[18,19] and more specifically to promote the engagement with

Clinical Points

- Digitally assisted parent training programs show efficacy across a range of therapy formats (eg, with and without therapist support) applied in real-world settings.
- The results demonstrate the potential for increased accessibility of evidence-based treatment for youth with disruptive behaviors through the provision of these programs.

and access to evidence-based programs through digitally assisted parent training programs (DPTs).[20–22] Interestingly, parent training aimed at addressing child behavior problems has been one of the first domains to introduce the use of technologies in older formats (eg, videotape, television) to engage parents outside of traditional treatment settings[23,24] and has shown preliminary efficacy in its self-directed digital forms.[25] However, while advances have been made in this field in recent years, no systematic review has thoroughly examined DPTs for treating disruptive behaviors among children and adolescents. The aim of this article was, therefore, to address this gap by systematically reviewing the literature on DPTs' efficacy and to map out the different program and intervention designs that were used in order to inform stakeholders regarding the state of the art in this domain and to identify main areas for future consideration.

METHODS

This review was carried out in line with the PRISMA statement.[26]

Data Sources

Computer searches of PubMed, PsycINFO, and EMBASE databases were conducted for studies published between January 1, 2000, and March 1, 2016. The search time window was limited to 2000 because of the rapid technology development[27] and to include technologies that largely meet the expectations of today's users.[28] To be inclusive, we used broad search terms in varying combinations for parent, training, technologies (eg, online, computerized, mobile), and disruptive behavior problems (see eAppendix 1 for complete PsycINFO search terms). A search for reference to technology was also conducted by author name, using the names of known experts in the area of behavioral parent training programs (eg, Dumas, Eyberg, Forehand, Jones, Kazdin, Patterson, Sanders, Webster-Stratton). Finally, reference lists of included and review articles were searched manually for additional references.

Selection of Studies

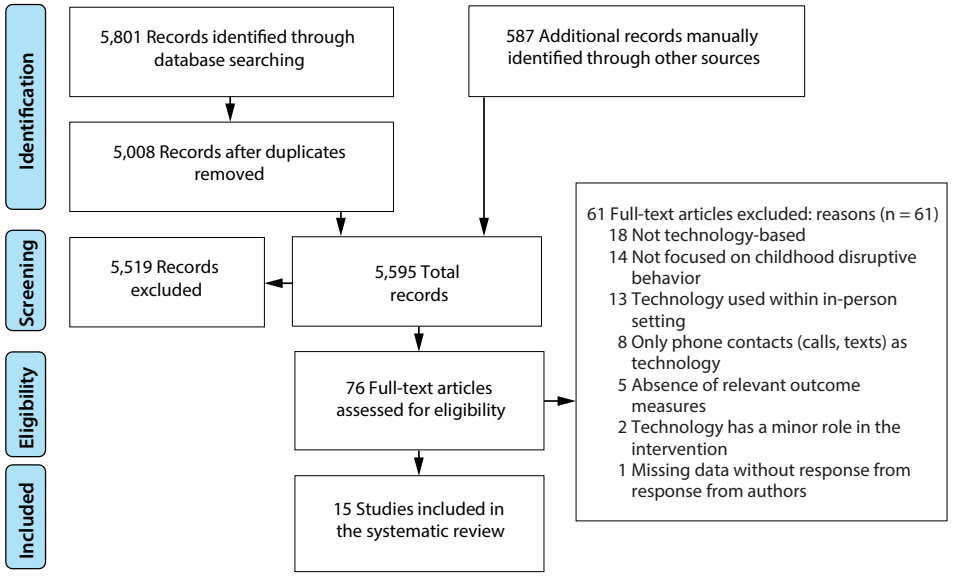
The search aimed to detect all studies assessing the effectiveness of DPTs aimed at children or adolescents with disruptive behaviors. Six criteria were used to select studies for inclusion: (1) the study was published in English and in a peer-reviewed source; (2) the study reported on a parent training intervention targeting the child's disruptive behavior problems measured with a valid scale (but not targeting criminal activities, child maltreatment, or general child rearing) with or without a control condition; (3) the program was designed to use digital media or software programs (eg, mobile app, DVD, online) not to be primarily used within a therapy setting (eg, group, face-to-face, each in the presence of a therapist); (4) the targeted children did not have developmental delay or physical health impairment; (5) the study reported standardized outcomes beyond satisfaction regarding child behavior (eg, Eyberg Child Behavior Inventory[29,30]); and (6) the study had at least 5 participants per group. The first 2 authors, a clinical psychologist and psychiatrist, independently assessed all potentially relevant articles for inclusion. Any disagreements were resolved through discussion and consensus.

Data Extraction

Two reviewers (A.B. with either A.P. or N.M.) independently extracted relevant data from selected studies, including (1) study design (eg, randomized trial, number of participants in each arm), (2) recruitment and sample characteristics (eg, child's age, severity level of symptoms), (3) intervention description, (4) theory and areas covered in the intervention, (5) digital program details (ie, main features), (6) user's attrition and engagement with the technology, and (7) main findings. To minimize reporting bias, efforts were made to extract and report positive and negative findings from the included studies. Severity level of undesirable child behavior at the beginning of treatment was coded as "clinical" when data indicated a clinical range of disruptive behavior disorders in the sample and was coded as "nonclinical" if data indicated that the study did not include mostly children in the clinical range of disruptive behavior disorders, based on standard measures (eg, Eyberg Child Behavior Inventory, Problem scale[29] score < 15) or inclusion criteria. Any discrepancies were resolved by consensus.

To organize the data extraction and analysis, 2 tables were created, 1 that describes characteristics of empirical studies and 1 that provides an overview of the digital programs used in the empirical studies. The results were then organized by the following sections: sample characteristics (age, socioeconomic background, clinical range of symptoms), methodological quality (assessment described below), intervention program characteristics (theoretical basis, number of sessions, time period, design and program components), availability of human support during the intervention, treatment recruitment and setting, program completion and user engagement, and treatment outcomes (which included a section on studies focusing on families with low socioeconomic status). Whenever studies were not all relevant for a certain section (eg, self-directed interventions), the group of analyzed studies was defined within that section. To avoid skewing the results, 2 sections, "intervention program characteristics" and "availability of human support," related to the number of different *programs* identified in the systematic review and not to the number of identified *studies* examining these programs.

Figure 1. Flow Diagram of Study Selection



Assessment of Methodological Quality

Methodological quality and procedures were assessed using the Cochrane Collaboration risk of bias tool.[31] The domains addressed were random sequence generation, appropriate allocation procedure (eg, allocation concealment prior to allocation time), incomplete outcome data, selective outcomes reporting, balance of baseline characteristics, and "other biases" (ie, problems not covered in other domains, such as inappropriate recruitment methods). Since it is not feasible to blind participants for behavioral treatment,[31] this assessment item is not presented. The first 2 authors independently assessed the studies' methodological quality. Any disagreements were resolved through discussion and consensus.

RESULTS

Search Results

The electronic and manual searches produced a total of 5,595 records. Through the first screening process, 76 articles were identified and retrieved for detailed evaluation (Figure 1).* A total of 15 studies[34–48] with 2,427 participants (1,500 in DPT conditions), 12 of which were randomized trials, met all inclusion criteria (Table 1). One of these studies[38] was related to the same intervention and sample examined in Enebrink and colleagues' work,[37] but it provided additional information. For clarity, we included these details in the presentation of the study by Enebrink et al[37] (accompanied by appropriate citation) and counted 14 intervention studies in our review.

Selected characteristics of the studies are presented in Table 1, and information regarding the digital intervention design, theoretical basis, and features is presented in Table 2. The 14 studies tested 10 different technology-assisted parent training interventions. One program (Triple P Online) was examined in 2 studies,[45,46] and 1 intervention design (Parenting Wisely/Parenting Toolkit for adolescents) was examined in 4 different studies.[35,36,39,47]

Sample Characteristics

Ten studies[34,37,40–46,48] were aimed at children aged mostly < 9 years, and 4 studies[35,36,39,47] were aimed at older children with an average age > 11 years. Five studies[36,39–41,47] specifically targeted families with low socioeconomic status, and the other 9 did not target a specific socioeconomic status. Finally, while 10 studies were focused on a population of children with a clinical range of symptoms, 4 studies[35,36,39,41] had data suggesting that the included children had only a subclinical range of symptoms. Among those, all except Love et al[41] were studies examining the same intervention design for adolescents.

Methodological Quality

The quality of the included studies is summarized in Figure 2. The randomized trials, focused on interventions for young children (average age < 9 years; studies = 9), mostly reported adequate study procedures and adequately reported the findings. In 4 studies,[34,35,39,47] it was unclear whether randomization was conducted with appropriate methods, and in 3 of these studies, all targeting adolescents,[35,39,47] it was unclear whether the allocation was concealed from relevant staff. Two of these studies,[35,39] however, provided analysis of groups at baseline showing no significant differences, suggesting that the randomization procedure was adequate. Two studies[34,47] did not address the question of incomplete

*A coach-assisted computerized version of Incredible Years[32] did not meet the inclusion criteria in terms of measured outcomes. Calam et al[33] examined a larger sample than that by Sanders et al.[34] However, it lacked additions of targeted outcomes and therefore only the latter was reviewed.

Table 1. Characteristics of Studies Assessing Digitally Assisted Parent Training Programs (DPTs) Targeting Children and Adolescent With Disruptive Behaviors

Study	Study Design	Remarks	Recruitment and Sample	Grouping: Clinical Symptom Level	Grouping: Treatment Setting[a]	Engagement	Main Findings
Cefai et al[35]	RCT Parenting Wisely, n = 40 Group, n = 39 WLC, n = 46[b]	The group condition viewed the program accompanied with a discussion facilitator	Advertisements (Australia) Age, 9–15 y (mean = 11.9), 50.9% male	Not within the clinical range	Local	38/40 Subjects (95%) in DPT completed the program	In comparison to WLC, DPT showed significant improvements in child behavior (ECBI mean $d = 0.17$) No significant differences were found between intervention groups Effects were maintained at 3-mo follow-up
Cotter et al[36]	Quasi-experiment Online Parenting Wisely, n = 38 In groups, n = 106	Parents were assigned to their preferred treatment formats	Community outreach (eg, churches; United States) Low SES; age, 11–15 y; 23% male	Not within the clinical range	Remote	All participants completed the 9 sessions	Significant improvement in child behavior (CBCL-externalizing scale, $d = 0.20$) that did not significantly differ from the group settings outcomes
Enebrink et al[37]	RCT DPT, n = 58 WLC, n = 46		Advertisements in newspapers/internet (Sweden) Age, 3–12 y (mean = 6.8), 57.7% male	Clinical range of symptoms	Remote	Participants completed an average of 5.72/8 sessions	In comparison to WLC, DPT had significantly greater improvement in child behavior (ECBI mean, $d = 0.87$) Effect continued to improve during the 18-mo period after the intervention, whereas parenting skills deteriorated[38]
Irvine et al[39]	RCT Parenting Toolkit, n = 155 WLC, n = 152		Local advertising (United States) Low SES; age, mean (SD), 13.1 (1.4), y; 52.9% male	Not within the clinical range	Local	92/155 Allocated participants (59.3%) began treatment 90 of 92 Participants beginning treatment (97.8%) completed it	In comparison to WLC, intervention group completers showed significant treatment effect for child behavior (ECBI mean $d = 0.20$)
Jones et al[40]	Pilot RCT BPT, n = 10 BPT + smartphone enhancement, n = 9		Community based (United States) Low SES; age, 3–8 y (mean = 5.7); 53% male	Clinical range of symptoms	Remote	15/19 Subjects (79%) completed the intervention (2 dropped out from each condition)	Smartphone enhancement condition descriptively improved child behavior (eg, between-group effect sizes favored the enhanced condition: ECBI mean $d = 0.76$) The enhanced group was more engaged with treatment (eg, BPT was significantly more likely to participate in midweek check-ins [93%] compared to the standard group [58%])
Love et al[41]	1-arm trial N = 155 (149 completed preassessments)		Agency programs (United States) Highly vulnerable families, low SES; age, 2–12 y	Not within the clinical range	Both	131/149 Subjects (87.9%) completed post assessments 61/149 Subjects (40.9%) completed all modules	Significant reductions for most child behavior indicators (eg, ECBI $\eta_p^2 = .02–.03$)
Morawska et al[42]	RCT DPT, n = 73 WLC, n = 66		School advertisements (Australia) Age, 2–10 y (mean = 6.1), 61.9% male	Clinical range of symptoms	Remote	DPT: 45/73 (61.6%) completed post assessments	Compared to WLC, the intervention group showed significant improvement in child behavior (ECBI mean $d = 0.47$) Effects were maintained at 6-mo follow-up
Porzig-Drummond et al[43]	RCT DPT, n = 42 WLC, n = 38[c]		Advertisements via internet (Australia) Age, 2–10 y (mean = 5.3) 50% male	Clinical range of symptoms	Remote	33/42 Subjects (78.6%) completed the program	Compared to WLC, parents completing the intervention reported significantly better improvements in child behavior (ECBI $d = 0.72$) Effects were maintained at 6-mo follow-up

(continued)

Table 1 (continued). Characteristics of Studies Assessing Digitally Assisted Parent Training Programs (DPTs) Targeting Children and Adolescent With Disruptive Behaviors

Study	Study Design	Remarks	Recruitment and Sample	Grouping: Clinical Symptom Level	Grouping: Treatment Setting[a]	Engagement	Main Findings
Rabbitt et al[44]	RCT Reduced contact, n = 46 Full contact, n = 40	Full contact included 8–11 fifty-min video conference sessions from the same therapists who participated in the reduced-contact condition	United States Age, 6–13 y (mean = 8.5), 58% male	Clinical range of symptoms	Remote	29/46 Children (63%) did not drop out from the reduced contact condition (vs 31/40 [77.5%] in full contact)	No significant differences were found in most outcome measures between groups, including therapeutic alliance measurement, and self-reported adherence to treatment Parents and therapist in the full-contact condition rated their experience of treatment as more acceptable A consistent improvement in child behavior was found in both groups (eg, CBCL Externalizing scale $d = 1.06$) No differences were found between groups and a matched benchmarked group of families receiving in-person parent management training
Sanders et al[34]	RCT Standard TV episodes, n = 231 Enhanced, n = 222[d]		TV and internet advertisements (United Kingdom) Age, 2–9 y (mean = 5.7), 64.9% male	Clinical range of symptoms	Remote	35.1% Of the original sample completed all assessments Participants watched an average of 4.46 episodes	No significant differences were found between the standard and enhanced conditions Significant improvement was noted for child behavior (ECBI mean $d = 0.50$) Effects were maintained at 6-mo follow-up
Sanders et al[45]	RCT DPT, n = 60 NTC, n = 56		Mass and local media (Australia) Age, 2–9 y (mean = 4.7), 67% male	Clinical range of symptoms	Remote	Participants completed an average of 5.38/8 sessions	Compared to NTC, parents receiving the intervention reported significantly better improvement in child behavior (ECBI mean $d = 0.80$) Effect was maintained at 6-mo follow-up
Sanders et al[46]	RCT Triple P Online, n = 97 Workbook, n = 96	The standard group received the 10-chapter *Every Parent's Self-Help Workbook*	New Zealand Age, 3–8 y (mean = 5.63), 67% male	Clinical range of symptoms	Remote	177/193 Subjects (91.7%) completed the programs	Triple P Online condition showed significant improvements in child behavior (ECBI mean $d = 1.13$) No significant differences were found between Triple P Online and workbook conditions Effect was maintained at follow-up
Segal et al[47]	RCT Parenting Wisely: IM, n = 21 NV, n = 21		Mental health clinics and local community (United States) Low SES; age, 11–18 y	Clinical range of symptoms	Local	Not reported	Both IM and NV significantly decreased reported child behavior problems (ECBI $d = 0.78$ and 0.83, respectively) without significant differences between groups
Sourander et al[48]	RCT DPT, n = 232 Education control, n = 232	Education control included access to a website with positive parenting strategies information and one 45-min coach phone call	A population based screening at age 4 y annual check-up (Finland) 61.9% male	Clinical range of symptoms	Remote	176/232 Subjects (75.9%) DPT received the allocated intervention 220/232 Subjects (94.8%) in education control	Compared to education control, the intervention resulted in significant improvement in child behavior (CBCL Externalizing scale $d = 0.34$ at 12 mo) and most psychiatric symptom measures (eg, internalizing symptoms, sleep)

[a]For treatment setting, local = within community based center or clinic, remote = accessed remotely, and both = parents could choose from both options.
[b]Some WLC subjects were referred to DPT or group treatment after 3 months and were included within the intervention analysis.
[c]Eighty-four participants were allocated to study condition; however, only 80 completed preassessments.
[d]Reported recruiting 454 participants but 453 were eventually described in the analysis.
Abbreviations: BPT = behavioral parent training, CBCL = Child Behavior Checklist, ECBI = Eyberg Child Behavior Inventory, IM = interactive multimedia delivered through computers, NTC = no treatment control, NV = noninteractive videotape presenting the scenes in a linear fashion, RCT = randomized controlled trial, SES = socioeconomical status, WLC = wait-list control.

Table 2. Overview of the Digitally Assisted Parent Training Programs Targeting Children and Adolescent With Disruptive Behaviors

Study	Theoretical Basis	Intervention	Digital Program Details
Cefai et al,[35] Cotter et al,[36] Irvine et al,[39,a] Segal et al[47]	Modifying parent-child interactions that reinforce antisocial behavior, using refraining and cognitive-restructuring methods to foster behavior change[49]	Parenting Wisely is a software program (CD-ROM) that also has an online delivery format[36] and is composed of 9 topics, commonly used in 2 sessions delivered over a period of 2 wk, followed by 2–3 wk during which parents are asked to implement strategies	Scenario-based learning[49]: after selecting a problem from a list of 9, parents viewed a 2- to 3-min video clip depicting a family struggling with that problem Parents selected a solution, viewed a video enactment of their solution, and participated in a critique of that choice The program used demonstration, quizzing, repetition, rehearsal, recognition, and feedback for correct and incorrect answers
Enebrink et al[37]	Based on the parent training program Comet,[50] which targets parent reactions and activities to promote behavioral change in parent and then the child	7 Online self-directed sessions distributed over a period of 10 wk Research assistants gave remote feedback through the website and distributed a new session each week (310 min of support per treatment)	Features included illustrations and videos of interactions between parents and children, downloadable material, multiple-choice questions with feedback, online diary, monitored parenting discussion forum, and the possibility to pose questions to a research assistant
Jones et al[40]	Based on Helping the Noncompliant Child (HNC)[9] Phase 1: Increase social attention to the child and reduce the frequency of competing verbal behavior Phase 2: Trains to give clear instructions and use nonphysical discipline procedures	Smartphone enhancement designed specifically to support HNC treatment protocol, which was composed of 8–12 weekly sessions conducted by trained MA-level graduate students	The enhancement included (1) 3-min skills videos for each of the taught skills, involving psychoeducation, as well as modeling of parent-child dyads; (2) daily surveys; (3) midweek therapist-parent video calls; (4) weekly videotaped home practice, which provided a "window" for therapists to relate to during session; and (5) text reminders and notifications
Love et al[41]	See Sanders et al[45] below	8 Modules (16-wk intervention) based on Triple P Online (see Sanders et al[45]) with a social media variant (Triple P Online community) designed for vulnerable young parents Participants could complete the program online or at local agency setting with desktops and internet access	Included Triple P Online design with these added social media features: (1) discussion boards for users, (2) "badges" to reward parents for practicing positive parenting strategies, (3) A virtual identity (an avatar) to promote peer support while maintaining anonymity, and (4) a Triple P–accredited facilitator to monitor the site (eg, answer questions, reward parents' shared work)
Morawska et al[42]	Based on the Triple P program (see Sanders et al[45] below)	7 Podcasts, 9–14 min each, available for parents in 3 phases over 2 wk, followed by 2 wk during which parents were asked to implement strategies	The format of these podcasts was conversational, in which the presenter asked the parenting expert questions relevant to the topics discussed Parents were e-mailed when a new set of podcasts was available to download
Porzig-Drummond[43]	1-2-3 Magic parenting program providing parents techniques and guidance on ways to reduce children's disruptive behaviors[51]	The program consisted of 2 digital videos (total of 226 min) viewed over 2 wk (DVD/online), followed by 2 wk during which parents were asked to implement learned strategies	The videos included psychoeducation and role-played video vignettes demonstrating maladaptive and adaptive parent-child interactions Parents also received tip sheets, which summarized the main points of the program.
Rabbitt et al[44]	Traditional parent-management training Practice, feedback, and shaping were used to develop parental skills and to bring about behavior change.	Reduced contact: 8 prerecorded weekly online sessions + bimonthly phone calls from a mental health therapist who was recorded in the sessions Weekly average therapist support time was 10 min	An assigned therapist used scripts based on a manual for parent training and recorded the sessions using professionally taped role plays (acting as the parents) A link to the sessions was sent via e-mail to the parents, who could also rewatch the sessions of prior weeks
Sanders et al[34]	Each episode presented parents learning to implement positive parenting skills, group processes, and footage of parent-child interactions	All intervention conditions watched *Driving Mum and Dad Mad*, a 6-episode, weekly television series	The series presented 5 families (9 parents) with 3- to 7-year-old children with severe conduct problems, participating in Group Triple P[51] Parents in the enhanced condition received the Triple P Self-Help Workbook[52] Enhanced program features included reminder e-mails providing tips on salient aspects of each episode, access to a website with tip sheets, and an e-mail helpline run by an accredited Triple P service provider

(continued)

Table 2 (continued). Overview of the Digitally Assisted Parent Training Programs Targeting Children and Adolescent With Disruptive Behaviors

Study	Theoretical Basis	Intervention	Digital Program Details
Sanders et al,[45] Sanders et al[46]	The Triple P program directs parents to promote nurturing behaviors, a low conflict environment, and children's social and emotional well-being through positive parenting practices[53]	Triple P Online: an 8-module, online self-directed software that took 8–12 wk to complete (approximately 56 min per module) Research assistant provided technical assistance and reminders to parents (11 min per participant)	The online program features included video-based modeling of parenting skills, diverse parent testimonials describing their experiences, personalized content including goal setting, interactive exercises to prompt parental problem solving, downloadable worksheets and podcasts to review session content, and automated text messaging and e-mail prompts to increase the likelihood of program completion
Sourander et al[48]	An internet version of the Strongest Families telephone-based program[54] Participants develop skills to strengthen parent-child relationships, reinforce positive behavior, reduce conflict, and encourage prosocial behavior	11 Weekly online sessions The program included weekly 45-min coaching phone calls from licensed health care professionals who also monitored the online program	Included exercises, instructional videos, and audio clips demonstrating the application of new skills Interactions within the website were personalized with the child's name, problems, strengths, and preferred activities Coaches had platform access to monitor the successful application of new skills, respond to questions, provide encouragement, and control parents' access to new sessions

[a]Irvine et al[39] study included the Parenting Toolkit program, which has the same theoretical base and design as Parenting Wisely.

outcome data. Two other studies[35,40] had unbalanced baseline characteristics between the groups: caregivers randomized to the intervention condition were more likely to report higher levels of child disruptive behaviors. In 2 studies, an "other bias" was identified. First, in Irvine and colleagues' study,[39] a gap was found between the simplicity of the recruitment process, which was conducted remotely and included $40 compensation, and the participation itself within the intervention group, which required participants to travel to community centers, resulting in low rates of participants beginning treatment in the intervention group in comparison to those completing pre-assessments. Second, in Cefai and colleagues' study,[35] 22 subjects from the wait-list control condition were referred to active treatment arms after 3 months and were included in the interventions analysis.

Intervention Program Characteristics

All programs identified in this review drew on behavioral approaches in which parents learned skills required to modify their interactions with their child in a way that reduces conflict and increases compliance (see Table 2). The mean (SD) number of sessions was 6.9 (2.8), delivered over 8.7 (4.2) weeks. In terms of intervention design, 4 programs were mostly noninteractive and did not enable participants to navigate between contents, offering a tunneled view of videos[34,43,44] or audio podcasts.[42] Most interactive programs (5/6; 83.3%) included online software with self-directed sessions, while Jones and colleagues' technological enhancement[40] was smartphone based, accessed solely via a mobile device.

Components used in the interactive programs included instructional videos modeling parenting skills as well as adaptive and maladaptive parent-child interactions (6/6 of the programs), multiple choice questions with direct feedback (4/6 of the programs), platform supporter (eg, responding to online posts, answering questions sent via internal mailing system; 4/6 of the programs), downloadable material (in 3/6 of the programs), automatic notifications and reminders (2/6 of the programs), and monitored discussion forum (2/6 of the programs). Jones et al[40] introduced weekly videotaped home practice to enable the therapist to review and provide feedback regarding parent skill development.

Availability of Human Support

Self-directed DPTs. Seven of the 10 programs (70.0%) were self-directed and did not require a professional input other than technical assistance.[34–37,39,41–43,45–47] One of these programs[37] required remote work of approximately 5 hours per treatment, which included feedback and distribution of sessions provided by a research assistant–level staff member.

DPTs combined with professional support. Three programs (30%) integrated technology with professional support. Jones et al[40] examined the use of technology to enhance standard treatment. The standard treatment included 8–12 guidance sessions conducted by therapists and master's-level graduate students, and it was enhanced by using a smartphone program developed specifically for the treatment protocol. This enhancement also included midweek video calls with a therapist. Rabbitt et al[44] used the technology to reduce the time that the therapist invested in treatment by providing the parent with prerecorded sessions and conducting brief bimonthly phone calls from a certified therapist. This program design decreased the amount of required human therapist time from approximately 50 minutes to 10 minutes per week. Finally, Sourander et al[48] presented a software program comprising 11 weekly online sessions. The program was assisted by licensed health care professionals who monitored parents' utilization of the program and provided coaching through weekly 45-minute phone calls.

Figure 2. Methodological Quality of Included Studies

Study	Type of Bias					
	Random Sequence Generation	Appropriate Allocation Procedure	Incomplete Outcome Data Addressed	Selective Outcome Reporting	Balance of Baseline Characteristics	Other Bias
Cefai et al[35]	+	+	++	++	- [a]	-
Cotter et al[36]	NA	NA	++	++	NA	++
Enebrink et al[37]	++	++	++	++	++	++
Irvine et al[39]	+	+	++	++	++	-
Jones et al[40]	++	++	++	++	- [b]	++
Love et al[41]	NA	NA	++	++	NA	++
Morawska et al[42]	++	++	++	++	++	++
Porzig-Drummond et al[43]	++	++	++	++	++	++
Rabbitt et al[44]	++ [c]	++ [c]	++	++	++	++
Sanders et al[34]	+	++	-	++	++	++
Sanders et al[45]	++	++	++	++	++	++
Sanders et al[46]	++	++	++	++	++	++
Segal et al[47]	+	+	-	++	+	++
Sourander et al[48]	++	++	++	++	++	++

Low risk of bias ++ High risk of bias - Unclear risk of bias + Not applicable NA

[a]At baseline, intervention conditions reported significantly higher child behavior problems compared to wait-list control.
[b]At baseline, caregivers randomized to the enhanced condition were more likely to report higher levels of child disruptive behaviors on the Eyberg Child Behavior Inventory (ECBI) Intensity scale compared to the standard condition; both groups evidenced problem behaviors in the clinical range on both the ECBI Problem and Intensity scale scores.
[c]Due to technical issues, the first 20 participants (23%) were assigned nonrandomly to 1 of the 2 treatment groups. Twelve of these participants completed treatment, 6 in each treatment group.
Abbreviation: NA = not applicable.

Treatment Recruitment and Setting

Twelve studies provided recruitment information. Most of these studies (11/12; 91.7%) reported outreach for potential candidates within the local community (eg, churches, in-house advertising) or through mass media (see Table 1). Sourander et al[48] was the exception using a population-based recruitment strategy, screening 4-year-old children attending annual child health clinic checkups in the catchment area location.

All studies reported the setting of intervention and most of them (11/14; 78.6%) investigated DPTs that were accessed solely remotely. Among these studies, Jones et al[40] assessed a software designed to be used remotely as an adjunct to standard ambulatory treatment, and Love et al[41] also included an option for participants to access the program within community centers. In the remaining 3 studies (3/14; 21.4%),[35,39,47] DPT was accessed within a community center setting.

Intervention Completion and User Engagement

As Table 1 illustrates, data regarding user engagement with the technological program were sometimes not available, and the level of noncompleters varied. The mean (SD) percentage of participants allocated to the intervention condition and reported as study completers (13 studies) was 79% (18.8%). Program participants completed a mean (SD) of 81.01% (18.1%) of available sessions (7 studies), and when including only programs with > 5 sessions, the mean (SD) percentage of completed sessions was 68.6% (13.1%) (4 studies). Love et al[41] examined user engagement in 2 study cohorts and reported that the completion rates of the entire 8-module program increased from 36% (cohort 1) to 51% (cohort 2). The authors noted several differences between cohorts: (1) twice as many parents in the second cohort completed the program on a smartphone, rather than desktop; (2) cohort 2 participants "enjoyed the buzz" and support generated from cohort 1 peers; and (3) a research assistant was more available to resolve technical issues.

Treatment Outcomes

Posttreatment improvements were reported in all studies. Results of studies utilizing self-directed DPT for young children revealed that in comparison to no treatment control conditions (studies = 4), DPT interventions exhibited medium to large effect size improvements in child behavior (Cohen *d* between 0.47 and 0.80).[37,42,43,45] In their study of highly vulnerable families with low socioeconomic status and a nonclinical range of symptoms, Love et al[41] reported that the DPT resulted in small pre-intervention to post-intervention improvement in child behavior (mean Cohen $d = 0.14$). In comparison to no-treatment control conditions, the self-directed programs for adolescents (2

studies; Parenting Wisely/Toolkit) exhibited significant but small effect size improvements in child behavior (Cohen *d* between 0.17 and 0.20).[35,39]

Jones et al[40] found that the technological enhancement of treatment helped low-income families to be more engaged with treatment (eg, increased participation in midweek check-ins) and that the enhancement may boost effect sizes for child behavior in comparison to standard treatment (Eyberg Child Behavior Inventory Cohen *d* between 0.54 and 0.99, descriptive difference). Sourander et al[48] reported significant small effect size improvement in child behavior (Cohen $d = 0.34$) among those receiving the online treatment integrated with phone coaching in comparison to usual care that included a brief psychoeducational component.

Studies comparing between different intervention designs. Five studies[34,36,44,46,47] compared between different intervention designs. Only 2 studies examined the difference between a DPT-led and therapist-led program, and both did not indicate clear differences in outcomes: Cotter et al[36] conducted a quasi-experimental comparison between Parenting Wisely online DPT and group-based treatment of the same program and did not reveal a clear pattern of differences in effect size for child behavior and for other investigated measures. Rabbitt et al[44] found no significant differences in most outcome measures between patients receiving full therapist support via video conferencing and those receiving the reduced support with technology enhancement. There was, however, a 14.5% lower attrition rate favoring those completing pre-assessments and post-assessments in the full-contact condition (77.5%) in comparison to those completing both assessments in the reduced-contact condition (63%). Three randomized controlled trials (RCTs)[34,46,47] examined the difference between interactive and noninteractive versions of the same self-directed interventions, and results indicated no significant difference between these different intervention designs in child behavior and other investigated measures (eg, parent behavior).

Studies focusing on families with low socioeconomic status. The background characteristics of the 5 studies[36,39–41,47] targeting families with low socioeconomic status differed significantly, making it difficult to identify clear outcome patterns for this important specific population. Three studies[36,39,41] targeted children with a nonclinical range of symptoms, and 2 of these studies[36,39] targeted mostly adolescents. The other 2 studies targeted children with a clinical range of symptoms, one being self-directed,[47] and the other being utilized as an adjunct to ongoing treatment.[40] These studies also differed in program length, with 3 studies[36,39,47] examining the same program format for adolescents taking approximately 2 weeks to complete and the other 2 studies[40,41] examining programs that took 8 weeks or more to complete.

All 3 studies targeting a nonclinical range of symptoms exhibited low effect size improvements in child behavior (eg, Cohen $d \leq 0.20$). For example, in their study of highly vulnerable families with low socioeconomic status and a nonclinical range of symptoms, Love et al[41] reported that the DPT resulted in small pre-intervention to post-intervention improvement in child behavior (mean Cohen $d = 0.14$). In contrast, Segal et al[47] also focused on a population of adolescents' families with low socioeconomic status, but with a clinical range of symptoms, and reported large effect size pre-intervention to post-intervention improvements in child behavior (Cohen *d* approximately 0.80). Finally, as noted above, the study by Jones et al[40] showed preliminary positive results in enhancing treatment outcomes for families with low socioeconomic status.

DISCUSSION

This first comprehensive systematic review of DPTs for disruptive behaviors in children and adolescents identified 14 intervention studies that met inclusion criteria, 12 of which were randomized trials. These studies examined 10 different programs introducing mostly behavioral approaches for teaching parents appropriate parenting skills to elicit behavior change among their children. Our review did not identify parent training programs using new forms of technology that are based on other approaches, such as the attachment theory[55] and play therapy (ie, child-parent directed play) as a first step in the therapeutic process,[56] approaches that were introduced in the past harnessing older forms of technology (eg, videotapes). This finding implies that currently, technology-assisted nonbehavioral parent training programs are not well presented. It is also worth noting that of the 15 reports relating to the 14 independent studies, only 3 were published before 2012, and 9 were published after 2013, indicating recent progress made in this area.

Self-Directed DPTs

Overall, we found that self-directed DPTs resulted in positive significant improvements in child behavior: studies focusing on young children (average age < 9 years) yielded medium to large effect size improvement in child behavior, while studies focusing on adolescents yielded a small effect size improvement in child behavior. However, most of the latter focused on samples with subthreshold clinical range of symptoms, which may have reduced the observable room for improvement, as evidenced in a previous meta-analysis[11] on parent training programs. Taken together, these results resemble the reported effect sizes for face-to-face parent training summarized by Lundahl et al,[11] which ranged from 0.24 to 0.69, and therefore indicate promising potential for these digital interventions in providing mental health care in a scalable way.

As seen in a systematic review[57] of computerized programs for children with depression and anxiety, attrition and engagement with treatment are major challenges when providing self-directed interventions. This review revealed average study completion rates of 79% for parents beginning treatment, resembling or being below the 25%–30% attrition rate noted for in-person interventions.[17,58,59] In addition,

the average program session completion rate for programs with more than 5 sessions was 68.57%, resembling the 72% participation rates reported in the past for in-person parent training.[17] Importantly, however, 2 self-directed DPTs reported low pre-assessment to post-assessment completion rates of 61.6% and 35.1%,[34,42] which suggest high attrition rates. This result may be attributed to certain features of the 2 studies: (1) remotely controlled recruitment procedures in which the pretreatment assessment was obtained from parents not being motivated to begin or complete the intervention and (2) delivery of a significant part of these 2 programs through a noninteractive design (podcasts, TV series), lacking most of the engaging features of other programs that included more than 2 sessions.

Another concern would be that DPTs may not provide similarly favorable attrition rates in comparison to in-person treatment when targeting vulnerable, low-income families. However, Love and colleagues' study,[41] which targeted children with a nonclinical range of symptoms, suggests that a mobile-based intervention with an interactive design that includes social media features may increase engagement (50% of participants finished viewing all modules) and may result in completion rates that resemble or surpass those reported in prior work[60] targeting prevention with low-income families (eg, 11%–62%). Nonetheless, more studies are required to provide data regarding the applicability of self-directed DPTs to engage vulnerable populations and prove the importance of interactive features in achieving satisfying engagement and attrition rates.

Programs Combined With Professional Support

The studies combining digital features of parent training with professional support provide an interesting view at the way technology could be leveraged across a range of human-based therapy. Rabbitt and colleagues' reduced-contact intervention design[44] resembles a prior study conducted by Nixon et al,[56] which used an earlier form of technology, videotapes, to reduce therapist time. These 2 studies suggest that a significant portion of the therapist work can be replaced with a recording of the therapist without relevant differences in outcomes. Rabbitt and colleagues' program[44] is intriguing as it (1) introduced this approach in a remotely administered setting; (2) reduced therapist time by approximately 80% (therapist average weekly time was reduced 5-fold, from 50 minutes to 10 minutes); (3) changed the professional contact setting from face-to-face sessions to phone calls; and (4) compared full- and reduced-contact conditions carried out by the same therapist, eliminating potential provider confounds.

However, despite these encouraging results, some challenges remain, including higher dropout rates for the reduced-contact condition compared to the full-contact condition (14.5% difference) and higher acceptability rates by both parents and therapists for the full-contact condition.[44] Subsequently, Sourander et al[48] offered a setting in which the coach support was delivered through phone calls, assisted by the use of an online interactive program. This hybrid design enabled the coach to maintain contact and monitor the consumers outside the session. Such a strategy might be used to engage people with other treatment designs, including those who use prerecorded sessions, in order to reduce attrition rates.

The results from both of these studies[44,48] reinforce the notion that technology can be used to broadly change the setting of professionally assisted interventions and to remotely engage parents at a convenient time and place to reduce constraints.[13,61–63] These designs may also increase the utilization of evidence-based treatment, as it generally is more feasible to train, supervise, and manage expert therapists for a certain illness if they are all located in the same center that covers a wide area of consumers, as shown by Sourander et al.[48]

Finally, Jones et al[40] used technology as an enhancement to evidence-based parent training in low-income families showing promising preliminary evidence regarding the use of mobile-assisted programs in increasing parents' engagement with services and treatment outcomes. This intervention design, currently being examined in a fully powered RCT,[64] is especially important, as it seems that face-to-face therapy will remain the main source of treatment in the years to come.[65,66] It is also worth noting that this intervention design might appear more appealing to professional therapists and therefore increase technology adaptation, since it might provide a way for them to improve patient engagement and satisfaction with treatments.

Limitations

Several limitations of this systematic review should be recognized when interpreting its results. First, this review was focused on published studies, and therefore it does not account for the "file drawer problem" by presenting comparable studies that were unpublished because of null results. This is common, however, to systematic reviews of this type. Second, some examinations within the Results sections are based on a small number of studies (eg, interactive vs noninteractive DPTs), and, as noted within the methodological quality assessment, a small number of studies were not RCTs and some lacked adequate power. However, we took these limitations into account when presenting and evaluating these studies and their results. Third, our ability to answer some questions was limited by the identified study characteristics, which differed on more than 2 aspects (see Table 1). Specifically, we could not examine the interaction between participants' engagement and intervention outcomes or between symptom level and engagement with the intervention because of the large number of potential moderators (eg, program length, treatment setting). This does not mean these questions are not important but rather that more studies are needed to address them specifically within the field of DPT.

Future Directions

Several areas in need for future research were identified. First, only 1 study[44] compared a form of digitally assisted

intervention to full therapist contact. Randomized trials comparing digitally led programs in their advanced interactive format and therapist-led programs are needed to better understand the therapeutic impact of these programs. Human involvement also differed among the digital programs; therefore, a clear conclusion regarding the effect of this involvement was not supported. Following prior work in other treatment domains,[67–69] studies that compare 2 groups receiving DPT that differ only in the extent of human support may shed some light on this subject. Subsequently, due to the importance of therapeutic alliance as a robust predictor of positive treatment outcomes,[70] it will be important to research if and to what degree therapeutic alliance can occur with a software program[71] and how variation in the strength of this variable might dilute or mediate outcomes when delivering self-directed treatments.

Second, while the recruitment procedures in most studies aimed at reaching people outside traditional treatment settings to reflect a broad public health delivery approach, none of these studies directly examined how these approaches resulted in earlier engagement with services or engagement in care of a population that would not otherwise receive these services. Randomized studies that reflect the effect of digital interventions in engaging people who otherwise would not receive treatment are needed in order to address one of the main reasons for developing these interventions. Subsequently, only 5 studies[36,39–41,47] focused on families with low socioeconomic background, and due to the differences in characteristics of these studies, it was difficult to determine whether DPTs provide a better opportunity to effectively reach out to these families that may face particular barriers with accessing traditional in-person therapies. Since this is a key question, more studies focusing on this population, especially with clinically relevant problem severity, are needed.

Third, the review revealed only 1 intervention design for parents of adolescents; the intervention was brief (including 2 sessions), and 75% of these studies targeted adolescents with subthreshold disruptive behavior symptoms. Therefore, on the basis of the current literature, it is not possible to determine that the effectiveness of DPTs differs between age groups and which targeted age groups will respond better to the format. Thus, additional studies of DPTs targeting different adolescent samples with clinically relevant symptoms are needed to inform stakeholders on this matter.

Fourth, it seems that studies comparing interactive (eg, online software) and noninteractive (eg, video) programs[34,47] did not present results that clearly favor a certain design. Moreover, looking into the 3 interactive and the 3 noninteractive arms in these studies revealed a wide variation of designs (eg, among the variety of noninteractive programs were a TV series, a workbook, and videos presenting parenting scenarios). Therefore, more studies comparing different DPT programs are needed in order to inform stakeholders about the impact and pitfalls of different digital intervention methods and to better synthesize their results.

Finally, since this review identified many variables that might impact DPTs efficacy, it seems that this field will benefit from a single gold standard study that treats many of these different aspects as experimental variables (eg, family socioeconomic status, recruitment method, user responsive technology, therapist contact). While such studies are costly and often challenging to conduct, we believe it would greatly increase stakeholders' understanding of the impact of different aspects on intervention outcome and clarify the value of DPTs for specific patient subgroups and clinical scenarios.

CONCLUSIONS

Technology-assisted parent training programs for disruptive behaviors showed efficacy both in self-directed and in human professional–assisted treatment formats, with satisfying program engagement rates. Preliminary results also indicate the promise of technology to enhance the effectiveness of standard treatment. While 1 study[48] presented a feasible design for program implementation in clinical practice and while most studies included outreach procedures that seem to fit a public health delivery approach, the potential of these programs to be implemented and increase the accessibility of effective parent training services to families who have difficulty accessing indicated treatment needs to be further examined.

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Supplementary material follows this article.

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Supplementary Material

Article Title: Technology-Assisted Parent Training Programs for Children and Adolescents With Disruptive Behaviors: A Systematic Review

Authors: Amit Baumel, PhD; Aditya Pawar, MD; Nandita Mathur, MA; John M. Kane, MD; and Christoph U. Correll, MD

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List of Supplementary Material for the article

1. eAppendix 1 PsychINFO Search Terms

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Appendix

PsycInfo search terms (time limits were set through the search engine's platform)

(Conduct OR CD OR behavior* OR behaviour* OR Oppositional OR defiant OR ODD OR anger OR aggressi* OR discipline* OR undiscipline* OR Impulse Control Disorder OR Impulse Control Disorders OR attention deficit OR attention-deficit OR attention-deficit-disorder OR ADHD OR hyperactiv* OR overactiv* OR inattent*) AND

(online* OR computer* OR internet* OR video* OR web-based OR website* OR mobile* OR smartphone* OR text-messaging OR texting OR sms OR digital* OR tech* OR ehealth OR e-health OR mhealth OR m-health) AND

(parent*) AND

(program OR educat* OR psychoeducat* OR train* OR self-training OR guid* OR self-guided OR skill* OR manag* OR therap* OR psychotherapy* OR treat* OR interven* OR self-help OR self-directed)